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A METHODOLOGY FOR MODIFYING RECORDED TRAFFIC DATA FOR EVALUATING THE PERFORMANCE OF DECISION SUPPORT TOOLS

PRESENTED BY

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Extended Abstract

A conflict is a situation where a violation of aircraft separation minima will occur if corrective action is not taken. A conflict probe is an air traffic management decision support tool that can detect conflicts, using information on aircraft position, speed, and flight plans, along with forecasts of wind and temperature profiles. A methodology is presented for generating conflict scenarios that can be used as test cases to estimate the operational performance of a conflict probe. Recorded air traffic data is used to preserve real-world errors that affect the performance of conflict probes. However, due to controller actions to separate traffic, such data generally does not contain actual violations of legal separation standards. Therefore, the track data is time shifted to create traffic scenarios featuring conflicts with characteristic properties similar to those encountered in actual air traffic operations (a conflict is defined as a predicted violation of minimum/legal separation standards).

First, a reference set of conflicts is obtained from trajectories that are computed using birth points and nominal flight plans extracted from recorded traffic data. Distributions are obtained for several primary properties that are most likely to affect the performance of a conflict probe; they are: (1) number of conflicts, and the distributions of: (2) encounter angle, (3) minimum horizontal separation, (4) minimum vertical separation, and (5) vertical flight phase (level or transitioning) of aircraft at conflict start. A genetic algorithm is then utilized to determine the values of time shifts for the recorded track data so that the primary properties of conflicts generated by the time shifted data match those of the reference set. A schematic of the methodology is presented in Fig. 1.

This methodology was successfully demonstrated using four hours of recorded traffic data, including over 1,600 tracks, for the Memphis Air Route Traffic Control Center. It found (see Fig. 2) that almost half (47%) of the tracks were time shifted by less than 1 min, and that 99% of the tracks were time shifted by less than 5 min; the maximum time shift was under 7 min. These

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results indicate that close matching of primary properties can be accomplished with a minimal temporal perturbation of the recorded tracks.

Distributions of some secondary properties were also determined, and compared for the reference and time shifted sets. It is emphasized that the time shifting process made no attempt to match the secondary properties. The objective of this exercise was to see how well some secondary properties match up, as a by-product of the explicit matching process for primary properties. The secondary properties selected were: (1) total number of conflicting aircraft, (2) conflict duration, i.e., time interval of separation loss, (3) average horizontal position of conflict partners at conflict start, (4) average altitude of conflict partners at conflict start, and (5) conflict rate. The distributions matched well qualitatively, and there was a fair match quantitatively as well. Hence, close matching of the primary properties used in this study additionally provides a good match for some other secondary properties.

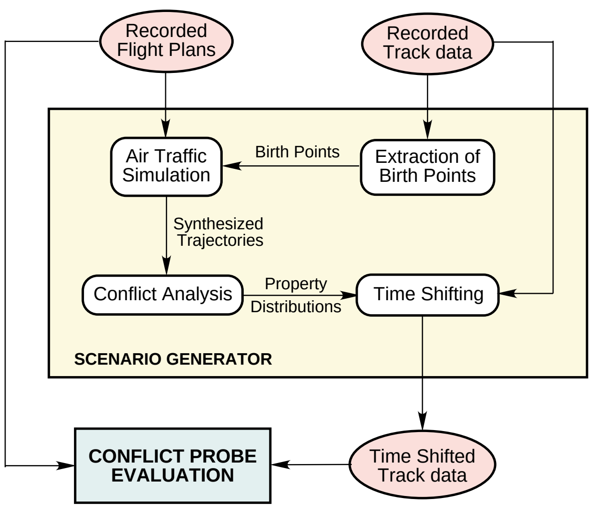

Fig. 1: Schematic of Scenario Generator

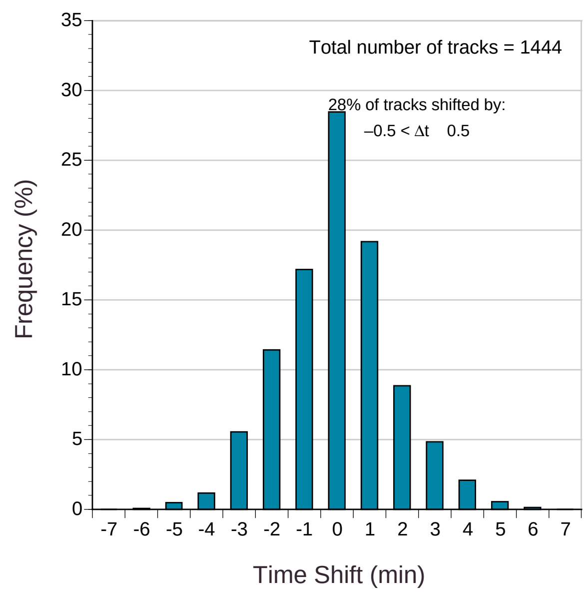

Fig. 2: Histogram of Time Shifts

Biographies:

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